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# FOREST MANAGEMENT PRACTICES TO PREVENT INSECT AND DISEASE DAMAGE TO SOUTHERN PINE

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# FOREST MANAGEMENT PRACTICES TO PREVENT INSECT AND DISEASE DAMAGE TO SOUTHERN PINE

by

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# INTRODUCTION

Demands for wood for lumber, fiber, and other wood products are rising. To meet these needs, we must do more than ever to reduce insect and disease outbreaks. The toll is high: an estimated loss of more than 10 billion cubic feet (283.2 million $m^3$), annually.

Salvage, use of chemicals, pile and burn and other controls are costly. These efforts, once infestations have occurred, are plainly not a cost-effective, long-term answer. The challenge must be met by forest management practices that prevent or limit insect and disease outbreaks.

This booklet takes a look at the hazards, or potential hazards—and ways to cope with them. Good forest management encourages vigorous tree growth, while creating an unfavorable environment for insects and diseases. Knowing the correct silvicultural measures to take allows us to evaluate the insect and disease hazard when it appears. We can then put selected practices into a management plan. The next step is to include these management practices in a work schedule. To make sure that your efforts are not wasted, take care to correctly apply the prescribed treatment.

# SOUTHERN PINE BEETLE[1]

The southern pine beetle (SPB) is a major cause of timber losses. This pest is ready to move in when loblolly and shortleaf stands become stressed. Factors leading to tree stress and to possible SPB outbreaks include:

- Prolonged moisture or drought stress in trees.
- Slow tree growth—common to overstocked and overmature stands.
- Sites having poor internal drainage or low soil fertility.
- Diseased and storm-damaged stands.
- Excessive damage to residual stands when cutting or doing other work.

Chemical sprays, pile and burn — salvage removal — and cut and leave may prevent additional tree loses in individual spots. Areawide control of the beetles has not been very effective. Several natural enemies—insect parasites and predators, disease agents such as bacteria, fungi, microsporidia and nematodes, as well as hungry woodpeckers—have provided some control. Subzero temperatures and long winters often kill many beetles—but don't count on this help. Although all these factors may help, they will not prevent future SPB outbreaks.

Research shows that SPB problems are directly related to forest conditions. Keep this in mind when you develop your forest management plans. Good stand management offers the cheapest, most practical, and longest lasting means of control, especially where beetle epidemics occur frequently. Recommended practices are:

1. Match your site with the right trees. Pines planted on the wrong site seldom have the vigor necessary to deter attacking beetles.
2. Alter stand density. If your stand's basal area exceeds its site index by 50 percent or more, thin it back to the site index. See figures 1 and 2.
3. Salvage promptly all lightning-struck, logging-damaged, diseased, and overmature pines when there are few beetles. These trees are important insect reservoirs.
4. Within the natural range of longleaf and slash pine, plant these species rather than loblolly or shortleaf.
5. Disturb the site and stand as little as possible. Exercise care in use of heavy equipment, road layout, culvert location, and other construction projects. Changes in drainage cause tree stress.
6. Harvest all mature trees at, or shortly after, rotation age.

# REPRODUCTION WEEVILS

These weevils often kill 20 to 30 percent of all pine seedlings planted in cutover, storm-damaged, burned or other disturbed areas. They may kill more than 60 percent of the seedlings in some areas. Two species are of primary concern: the pales weevil[2] and the pitch-eating weevil[3]. The adult weevils are attracted to the odor of fresh pine resin. They deposit their eggs in the large roots of fresh pine stumps where the larvae can develop. Adult weevils emerge and feed on the tender bark of pine seedlings. They chew small, irregular-shaped holes in the bark. Heavy feeding girdles the stem. Most of the damage occurs from February through June,

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[1] *Dendroctonus frontalis* Zimmerman.

[2] *Hylobius pales* (Herbst).

[3] *Pachylobius picivorus* (Germar).

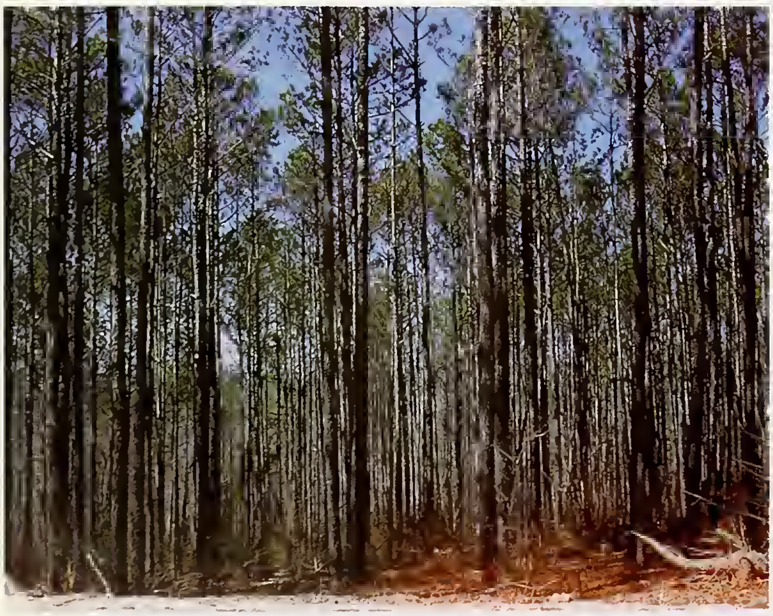

**Figure 1.—Young, dense stand of pine attacked by southern pine beetle.**

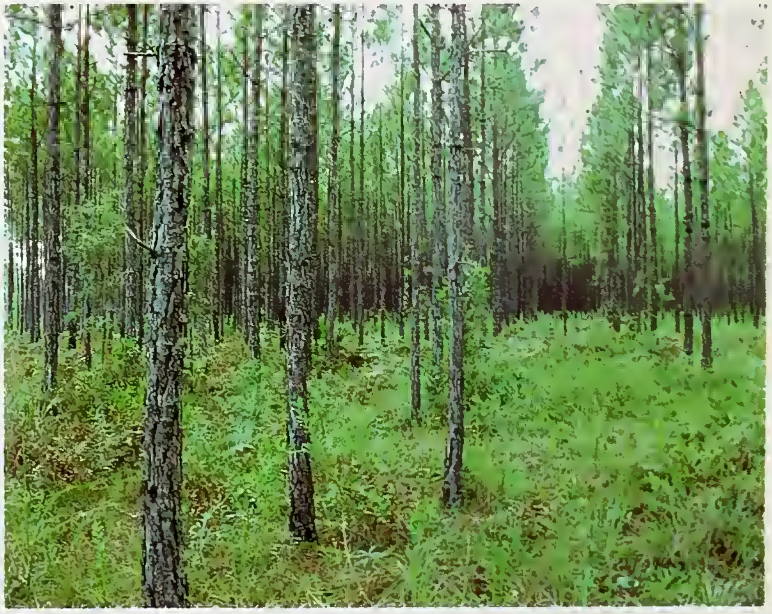

**Figure 2.—Thinned, clean stand of pines is a low risk for attack by insects.**

with a lesser amount in the late summer and early fall. All southern pines are susceptible. These practices will help minimize damage:

1. Harvest timber and prepare sites 6 to 9 months before you plant. During this time, stumps will decay enough to lose their attractiveness. Weevil larvae in the roots of the stumps will have matured and left in search of better food sources. Time your operations to take advantage of the weevil's life cycle, as shown in table 1.

**Table 1.—Hazard-rating schedule for timing operations to minimize potential problems from weevils.**

| Harvest date | Site prep date | Site Hazard | Recommended |
|---|---|---|---|
| Before June | Before June | None | Plant pines Nov.-March |
| | After June (less 5 cords/acre) | None | Plant pines Nov.-March |
| | (over 5 cords/acre) | Low-moderate | Plant pines the following year or contact insect control specialist. |
| After June | After June | Low to high | |

2. Prescribe burn to prepare the site. If you use mechanical methods, you may prolong the attractiveness of the area to the weevils.

3. Plant treated seedlings in March and early April on sites that may have a lot of weevils.

4. Make regeneration cuts during seedfall because newly germinated seedlings suffer only minor damage. The weevils should be gone by the time the seedlings are in the second growing season.

## PINE TIP MOTHS[4]

Tip moth larvae kill buds and twigs of young loblolly and shortleaf pines. Attacks by as many as four generations a year can stunt the trees during the first 5 or 6 years. The Southwide Tip Moth Study showed that severe tip moth problems may result in volume losses of 3.9 cords per acre (20.5 $m^3$/ha)—at 16 years, for loblolly pine. However, only pines on the poorest sites are likely to suffer serious growth loss from the tip moths. Chemical control is possible, but at present seems impractical because treatments must be repeated. Use other measures in high hazard areas:

1. Plant slash or longleaf pine within their normal range, rather than loblolly or shortleaf. Only longleaf and white pine are immune; however, tip moths are less of a problem on slash pine than loblolly and shortleaf pine.

2. In conversion planting, do not mechanically prepare the site. You will have fewer moths, and parasites of the moths are more active under the partial shade of hardwoods deadened by a spray or injection of herbicides.

3. Don't kill off all the plants on field sites; grass and weed cover reduces tip moth problems in the first year or two.

## WHITE GRUBS[5]

These larvae of May or June beetles feed chiefly on the roots of grasses, weeds, or other plants. They destroy the roots of planted or directed-seeded pines in areas covered with sod. Seedlings less than 2 years old are most likely to be killed. Affected seedlings droop and turn yellow or brown, and can easily be pulled up. Many grubs are often found in the more fertile soils with good sod cover.

Before planting, sample grassy areas by turning over the soil at random with a spade. Break the sod apart to expose the grubs. They are plump and six-legged, with brown heads and white bodies. If you find more than one per cubic foot (or about 28.3 $cm^3$), take these measures:

1. In August, plow furrows in 4-foot-wide (1.2 m) strips, at the desired planting spacing. Plow furrows deep enough to destroy the sod cover. Expose, but do not bury the top soil. Many exposed larvae will be killed by the sun's heat, by the drying of the soil, or by birds. Many more larvae will starve.

2. On areas to be direct seeded, disk deeply to destroy much of the sod cover.

## ANNOSUS ROOT ROT[6]

This fungus disease kills many pines in thinned stands in certain areas of the South. Look for it when trees begin to die in the second or third year after thinning and losses continue for several years. High-hazard sites have at least 12 inches (30.5 cm) of sand over heavy clay. The disease is common and severe on old fields. Low-hazard sites have poor internal soil drainage and high seasonal water tables or the depth to clay is less than 12 inches (30.5 cm).

Manage your stand as shown in figure 3. Some additional ways to reduce losses on high-hazard sites are as follows:

1. Prescribe burn at least twice before thinning, once in the 6 months preceding cutting. Repeat once or more after thinning.

2. Reduce the number of thinnings per rotation by either using spacing wider than 8x8 feet (2.4 x 2.4 m), or thinning to basal areas of less than 70 square feet (6.5 $m^2$).

3. Regenerate immediately following harvest because seedling losses should not exceed 1 to 5 percent. Keep out disease by spraying or dusting as shown in figures 4 and 5.

## FUSIFORM RUST[7]

This disease was rare before 1930, but is now widespread. It is more of a problem in the most actively managed plantations. Fire control has increased the proportion of oaks, which serve as alternate hosts for the disease. Planting a highly susceptible species, such as slash pine, out of its natural range has also increased disease problems. In addition, many nurseries now ship ungraded seedlings which may have infection levels as high as 5 percent.

Take these steps to reduce fusiform rust:

### Identify High-hazard Sites

Rust is more of problem on moderate to well-drained soils that have sandy surface horizons underlain by clays. Stands on poorly drained or infertile soils where phosphorus is limited are less affected. The maps in figures 6 and 7 show the general areas of high-hazard sites. Problems with rust are likely in these areas. Because local sites vary, survey the adjacent pine plantings to see if you are likely to face a rust hazard on your site.

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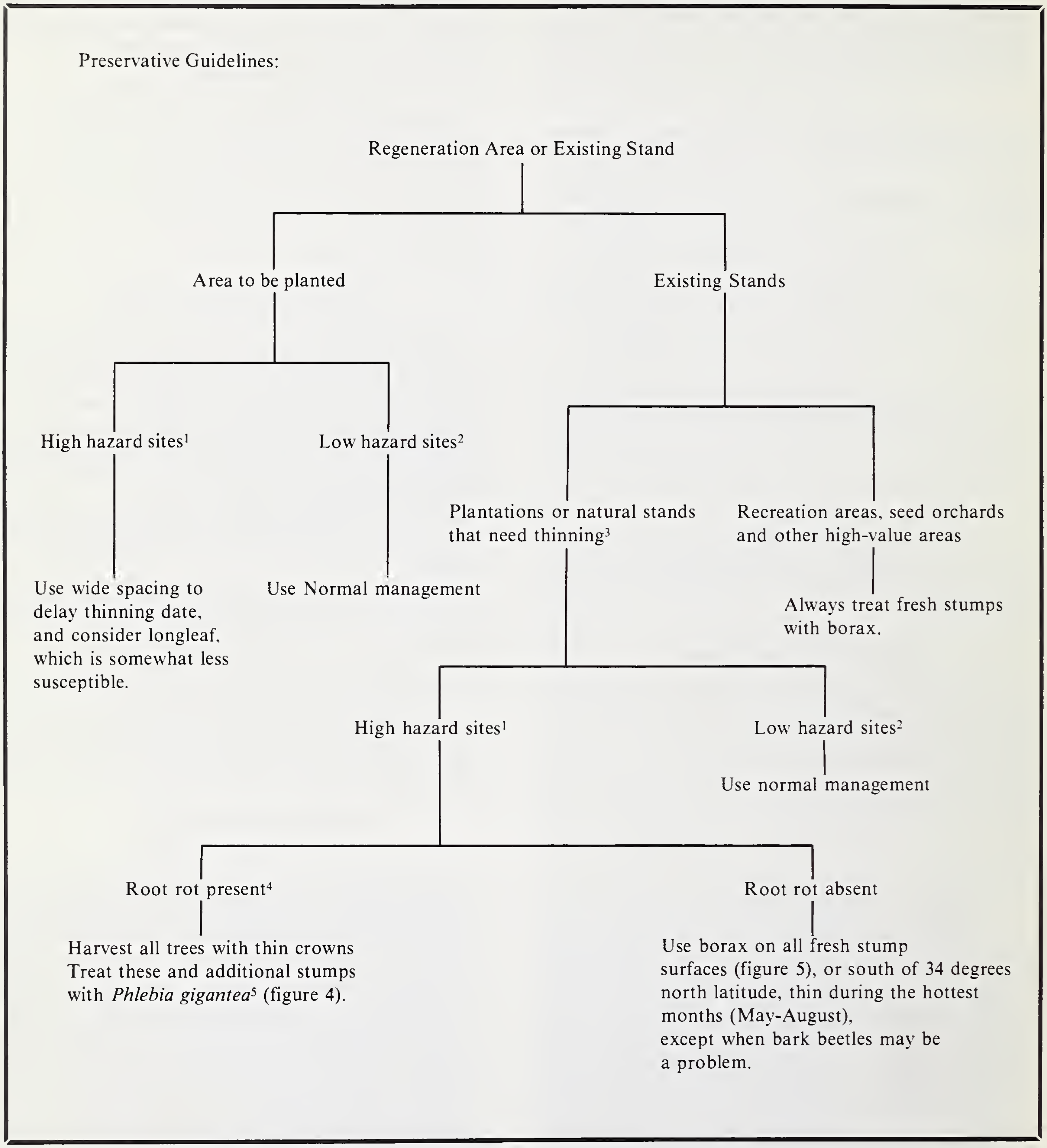
[4] *Rhyacionia* species.

[5] *Phyllophaga* species.

[6] *Heterobasidion* annosus.

[7] *Cronartium quercum* (Berk) Miyabe ex shirai f. sp. *fusiforme*.

Figure 3.—HOW TO MANAGE SOUTHERN YELLOW PINE STANDS TO REDUCE ANNOSUS ROOT ROT.


Preservative Guidelines:
Regeneration Area or Existing Stand
Area to be planted
Existing Stands
High hazard sites[1]
Low hazard sites[2]
Use wide spacing to delay thinning date, and consider longleaf, which is somewhat less susceptible.
Use Normal management
Plantations or natural stands that need thinning[3]
Recreation areas, seed orchards and other high-value areas
Always treat fresh stumps with borax.
High hazard sites[1]
Low hazard sites[2]
Use normal management
Root rot present[4]
Root rot absent
Harvest all trees with thin crowns Treat these and additional stumps with *Phlebia gigantea*[5] (figure 4).
Use borax on all fresh stump surfaces (figure 5), or south of 34 degrees north latitude, thin during the hottest months (May-August), except when bark beetles may be a problem.

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[1] Includes soils with sand or sandy loam textures to a depth of 12 inches (30 cm) or more without poor internal drainage or high seasonal water table.

[2] Includes all soils with poor internal drainage or high seasonal water tables. Also includes well drained sites where heavy clay is within 12 inches (30 cm) of the surface.

[3] Natural stands on high hazard old fields may be vulnerable to heavy damage from root rot if they are structured and managed like plantations.

[4] Harvest before annual losses exceed annual gain, or when more than 19 percent of the trees are infected in the first 5 years after thinning.

[5] Formerly called *Peniophora gigantea*. This is a control agent.

## Avoid Fusiform Rust in Young Stands

### Management of the Pine Hosts

1. Avoid planting rust-susceptible pines on high-hazard sites, when possible. Plant or seed high-hazard sites with resistant species, e.g., longleaf, and sand pine on dry, sandy sites. Plant shortleaf in the Piedmond or Upper Coastal Plain where littleleaf disease is not a problem. Or, use seed or seedlings from resistant-seed sources. Do not plant species beyond their natural range, unless supported by research.

2. Do not move or plant rust-infected nursery stock. Insist on graded seedlings from which all galled stock has been culled.

3. If you have enough rust-free trees for use as seed trees, consider a seed tree regeneration system in high-hazard areas.

4. Increase planting density to make up for expected losses in high hazard areas. Plan thinnings to remove infected trees to reduce the amount of rust in the stand.

5. Selectively thin rather than row-thin plantations in which more than 25 percent of the stems are diseased. Loblolly with less than 50 percent, or slash with less than 60 percent of the stem circumference cankered can be left when making the first thinning, if the stand will be thinned again within 10 years. Such stem-cankered trees will live at least 8 years longer unless broken off by the wind.

6. In seed orchards, high-value stands and intensively managed plantations, consider pruning cankered limbs. Remove limbs with galls more than 4 inches and less than 15 inches from the bole. Prune from midsummer to midwinter.

7. On moderate to high-hazard sites, fertilizer may increase problems with rust. Delay use of fertilizers until the trees are 8 to 10 years old.

### Management of the Oak Hosts

The effectiveness and benefits versus cost of killing susceptible oaks species (e.g., water, laurel and willow oak) remain to be proven. However, management practices which suppress oak are expected to reduce problems with rust. Follow these practices when practical and not in conflict with other important uses of the forest. The indiscriminate eradication of oak trees is **not** recommended. Give careful attention to the value of oaks for wildlife food and habitat. Oaks also have important aesthetic and realty values.

## Minimize Disease Losses in Adequately Stocked, Rust-infected Stands

A. You may want to manage for poles or sawtimber in adequately stocked stands in high-hazard areas if less than 20 percent of the trees have stem cankers on the main stem or within 12 inches (30.5 cm) of the main stem at age 8.

B. In general, stands 9 to 15 years old, with less than 25 percent of the trees with main stem cankers, may be grown for pulpwood without thinning early to control rust. If grown for a longer period, you may need to remove stem-cankered trees.

C. In stands 9 to 15 years old, if 26 percent or more of the trees have main stem cankers, make a sanitation thinning. If this thinning would result in inadequate stocking, clearcut and plant resistant seedlings or, where appropriate, use a seed tree system.

D. During prescribed burning, take care to avoid igniting stem cankers. Charring and possible death of the trees may result.

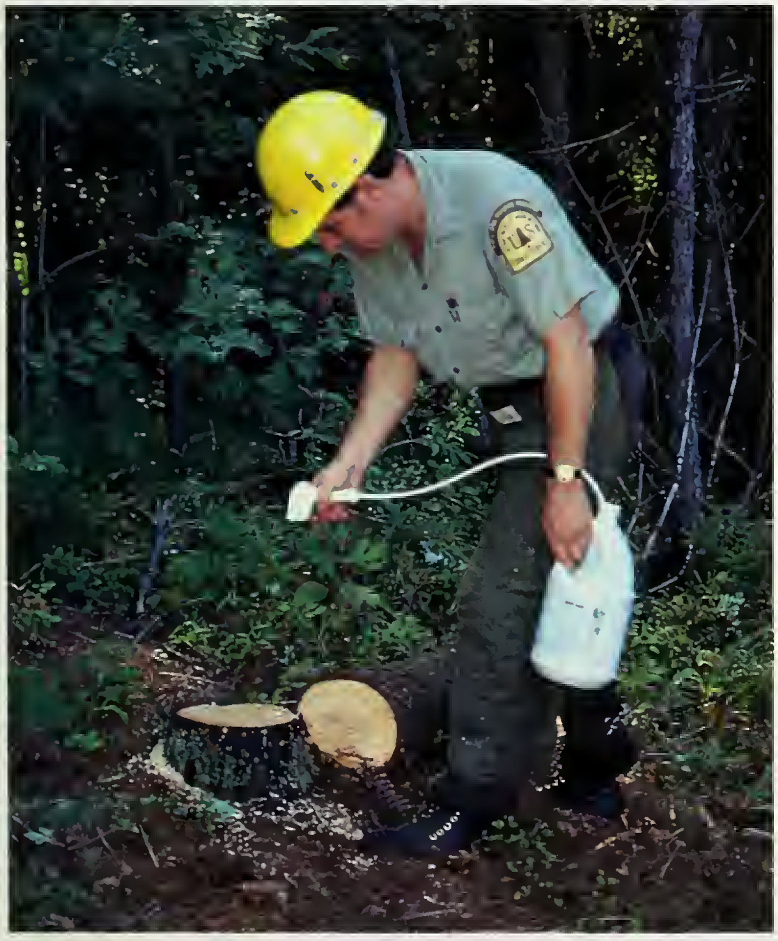

**Figure 4.—A biological control agent, *Phlebia gigantea*, sprayed on stumps will attack the fungus that causes annosus root rot. Use this treatment in or near areas where root rot has been reported.**

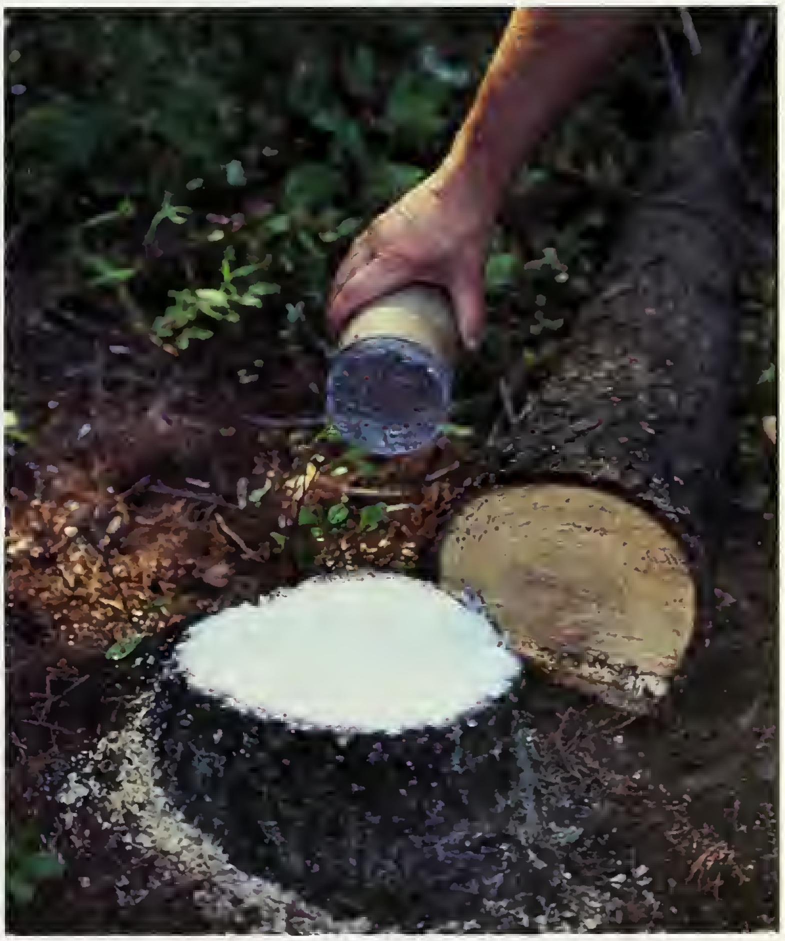

**Figure 5.—Dust stumps with borax in areas where root rot is not present—it's cheap insurance against future attacks.**

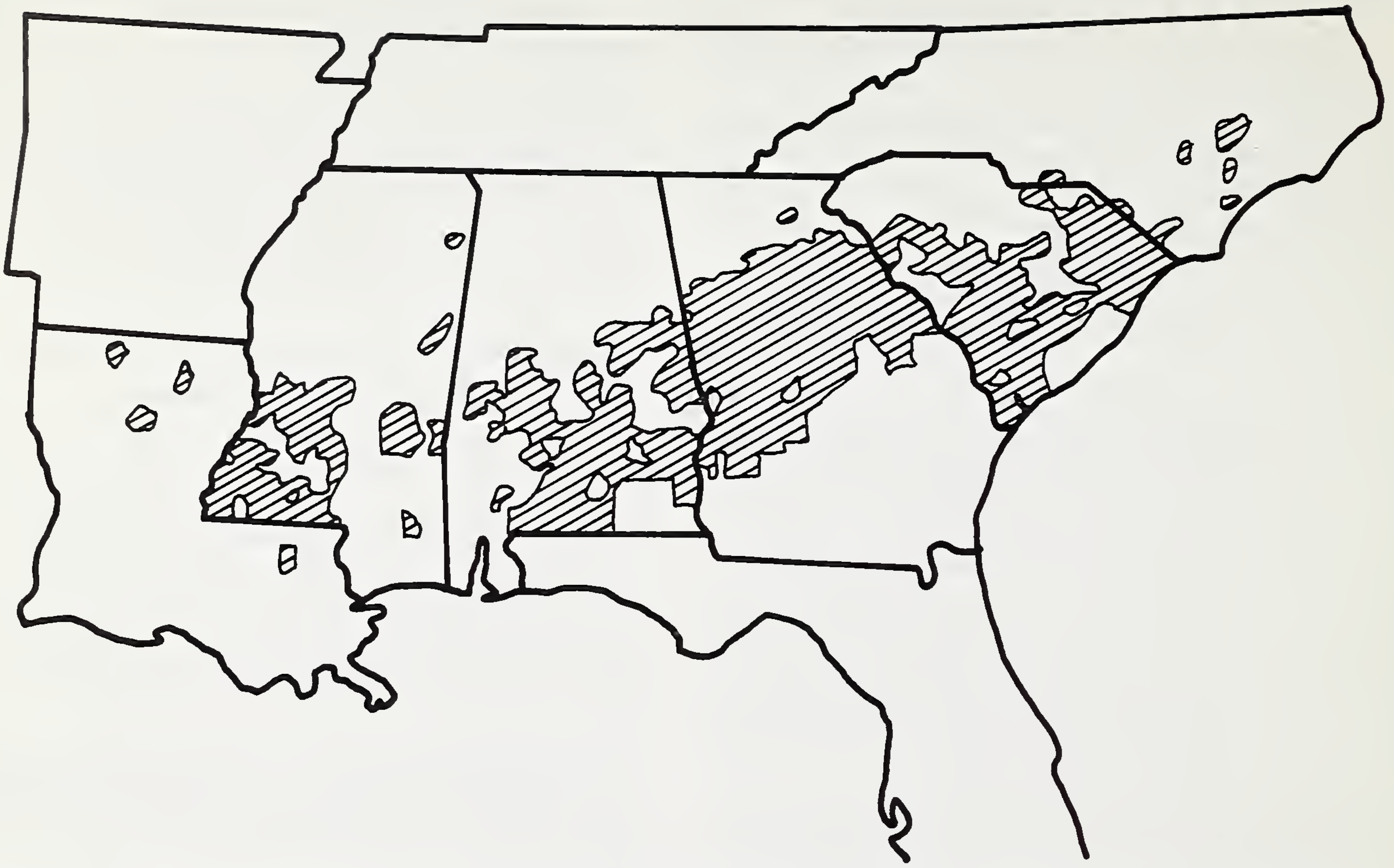

Figure 6.—Incidence of fusiform rust in 8- to 12-year-old loblolly pine plantations, 1971-73. Shaded areas indicate 51-100 percent infection.

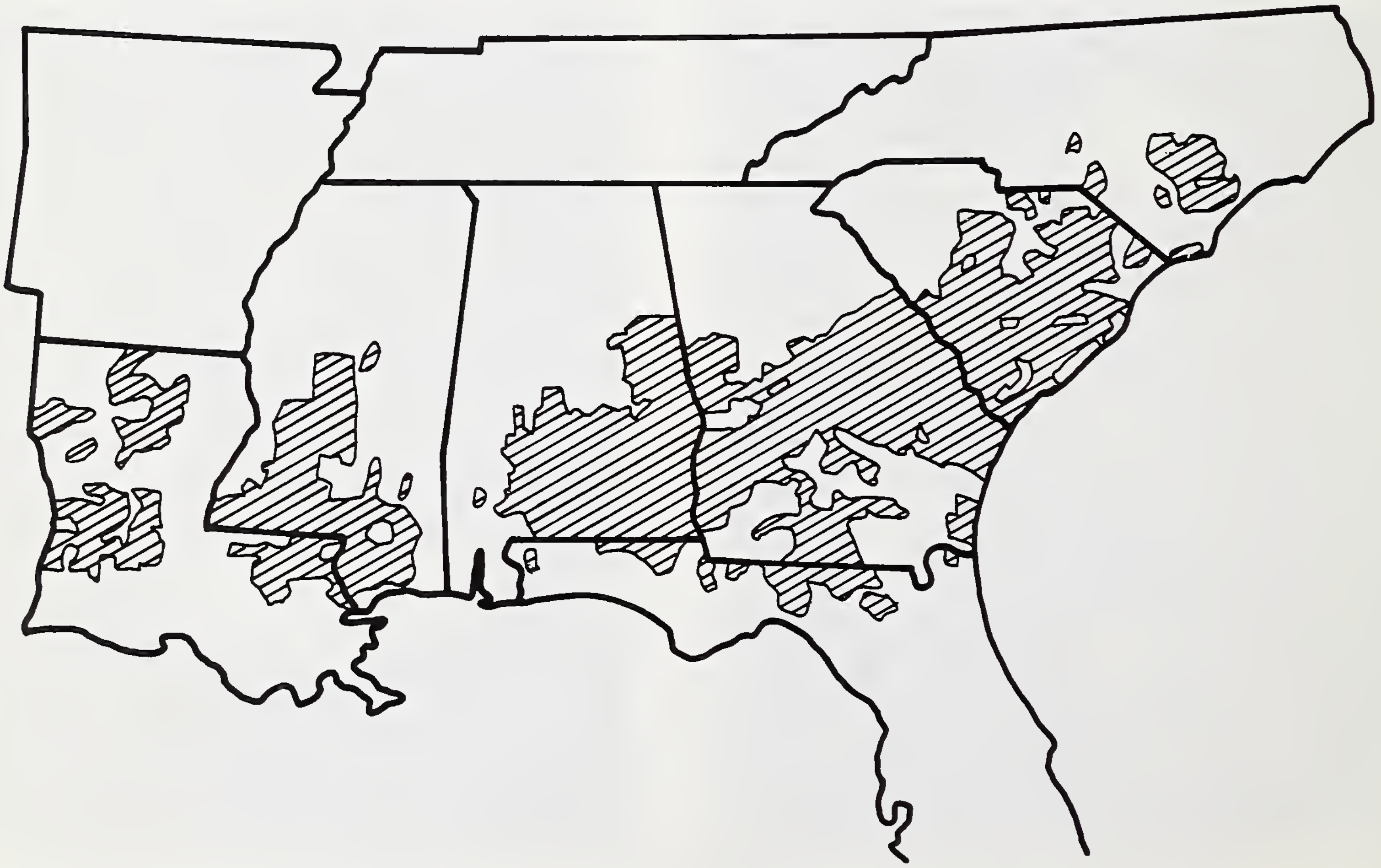

Figure 7.—Incidence of fusiform rust in 8- to 12-year-old slash pine plantations, 1971-73. Shaded areas indicate 51-100 percent infection.

E. Manage 16- to 20-year-old slash pine stands as shown in figure 8.

## BROWN SPOT[8]

This disease is a major problem in managing longleaf pine. Infected seedlings in the grass stage may lose some or all of their needles. Three successive years of complete loss of needles usually kills the trees. Continued partial loss of needles prolongs the grass stage of longleaf for up to 20 or more years. The grass stage usually lasts 3 to 5 years in healthy, longleaf pine. This delay in height growth is one of the main reasons slash and loblolly pines are grown on former, longleaf pine sites.

Use these practices to promote early height growth and reduce problems with brown spots:

1. Plant resistant seedlings or (if lacking those) high-quality longleaf seedlings on intensively prepared sites. Get seedlings only from nurseries that (a) maintain seedbed densities at 10 to 15 seedlings per square foot (929 cm²), and (b) produce disease-free seedlings by regularly scheduled fungicidal treatments up to the time of lifting.

2. When seed trees are used to regenerate longleaf pine stands, burn in the fall before seedfall to bare the mineral soil and to destroy the diseased needles on seedlings (figure 9). The treatment reduces the amount of fungus spores that may infect the new crop of seedlings.

3. Where seedlings are established, burn the site during the dormant season after the seedlings achieve a ground line diameter of 0.3 inch (8 cm). Burn before height growth starts—usually when the root collar is 1 inch (2.5 cm) in diameter. This practice reduces competition from grass and hardwoods and destroys the fungal spores and diseased tissue that are present. Fire kills seedlings that have just begun height growth, particularly those heavily diseased. Once the seedlings are 3 feet (91 cm) or taller, a light fire at 3- or 4-year intervals does little harm and helps to control competition and disease buildup. Remember, poor timing of fires can kill seedlings.

4. Remove competition of seed trees or a shelterwood at seedling age 1 or 2 years. The seedlings will get a better start, and fewer will die during the logging of older trees.

Research shows that significant disease reduction results from the use of systemic fungicides at the time of outplanting. After more research, this type of control may be ready to use in 3 to 5 years.

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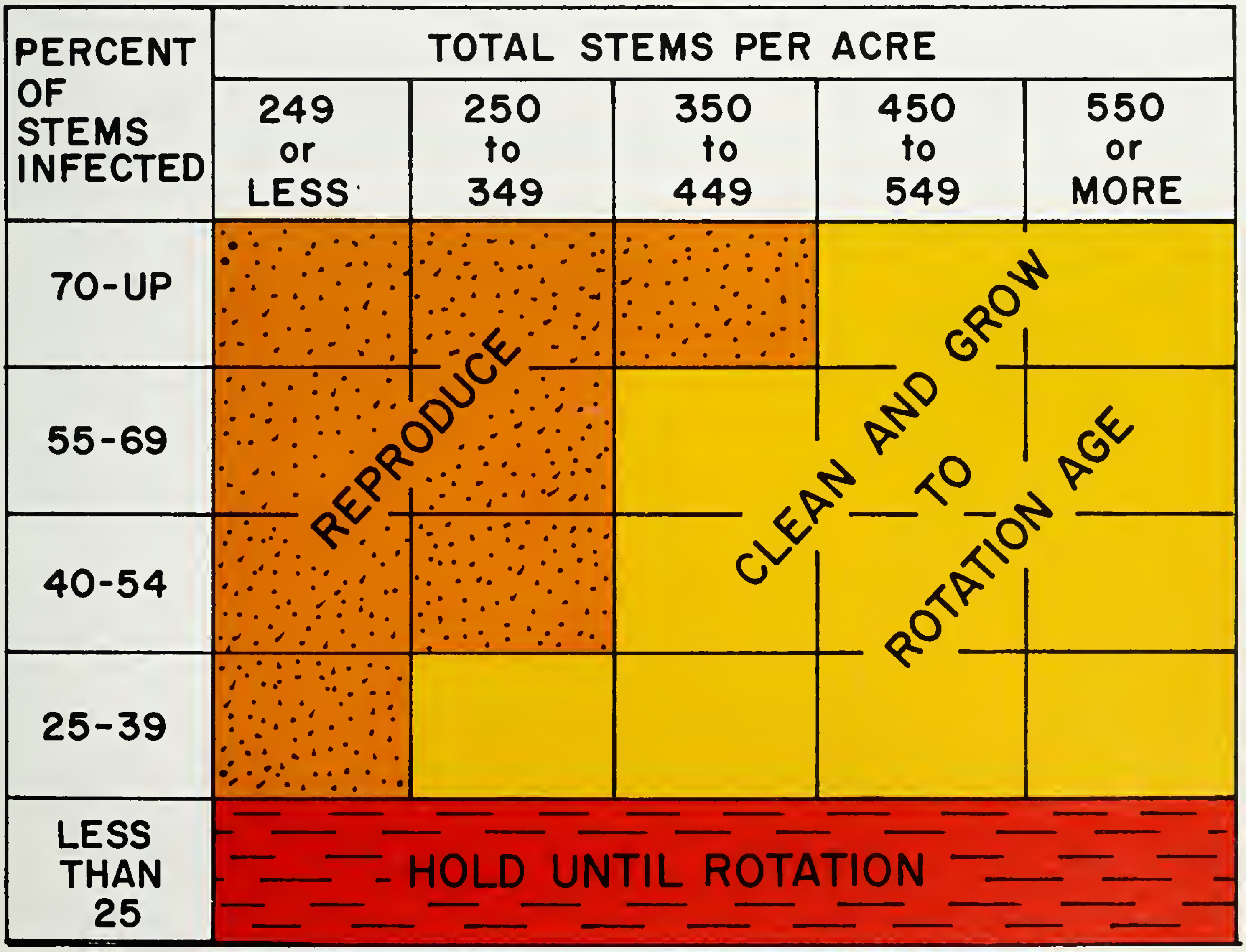
[8] *Scirrhia acicola.*

**Figure 8.—Guidelines for choosing between removing or thinning fusiform rust infected 16- to 20-year-old slash pines stands.[1],[2]**



| PERCENT OF STEMS INFECTED | TOTAL STEMS PER ACRE | | | | |
|---|---|---|---|---|---|
| | 249 or LESS | 250 to 349 | 350 to 449 | 450 to 549 | 550 or MORE |
| 70-UP | REPRODUCE | REPRODUCE | REPRODUCE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE |
| 55-69 | REPRODUCE | REPRODUCE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE |
| 40-54 | REPRODUCE | REPRODUCE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE |
| 25-39 | REPRODUCE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE | CLEAN AND GROW TO ROTATION AGE |
| LESS THAN 25 | HOLD UNTIL ROTATION | HOLD UNTIL ROTATION | HOLD UNTIL ROTATION | HOLD UNTIL ROTATION | HOLD UNTIL ROTATION |

Source: *Management of fusiform Rust in Southern Pines Symposium Proceedings, 1977.*

[1] Thinning involves the removal of all trees with stem cankers on more than 50 percent of the bole circumference or in a fork. Eliminate every fifth row for access.

[2] Belcher, H.J., W.J. Craft, W.D. Erickson, and R.H. Ward. 1977. Fusiform rust management strategies in practice: Plantation Management. In Management of fusiform rust in southern pines, Symp. Proc. Univ. Fla., Gainesville. p 158-163.

## LITTLELEAF DISEASE

Littleleaf is a major problem with shortleaf pine and, to a lesser extent, loblolly pine in Alabama, the Piedmont of Georgia, North Carolina, South Carolina, and Virginia. Littleleaf disease is also a problem with the same species in parts of Mississippi, Kentucky, and Tennessee. Little leaf is caused by complex factors involving the soil fungus *Phytopthora cinnamomi,* which kills the root tips. Under prolonged moisture stress, low fertility, and poor aeration, feeder roots are not replaced. Tree vigor suffers accordingly. Stands under 20 years of age or 3 to 4 inches (7.6 to 10.2 cm) in diameter are rarely attacked. Affected trees generally live only 5 to 6 years after attack. Some die in as little as 1 year. Minimize losses by employing these guides:

1. If less than 10 percent of the trees in the stand are diseased, thin to remove diseased trees at 10-year intervals.
2. If 10 to 25 percent of the trees are diseased, remove all diseased trees on a 6-year cutting cycle.
3. Clearcut stands with more than 25 percent infection. Following clearcutting, manage for loblolly pine or other species, such as hardwoods, which are more resistant.

Disease-resistant shortleaf has been found. Progeny test results at age 25 are anticipated this year. Rapid growth may be related to resistance to littleleaf.

## CONCLUSIONS

Several factors stand out in insect and disease prevention. In artificial stand regeneration the biggest mistake made has been to use the wrong species or seed source. Do not overlook the virtues of longleaf, which resists or is immune to attack by many pests. It should be planted within its range in far greater numbers than is now the practice.

Finally, maintenance or improvement in tree vigor is the basis of prevention. Lack of systematic management, whether it be indiscriminate cutting, poor prescription, or total exclusion of cutting, invites problems. Professional management is that "ounce of prevention worth a pound of cure."

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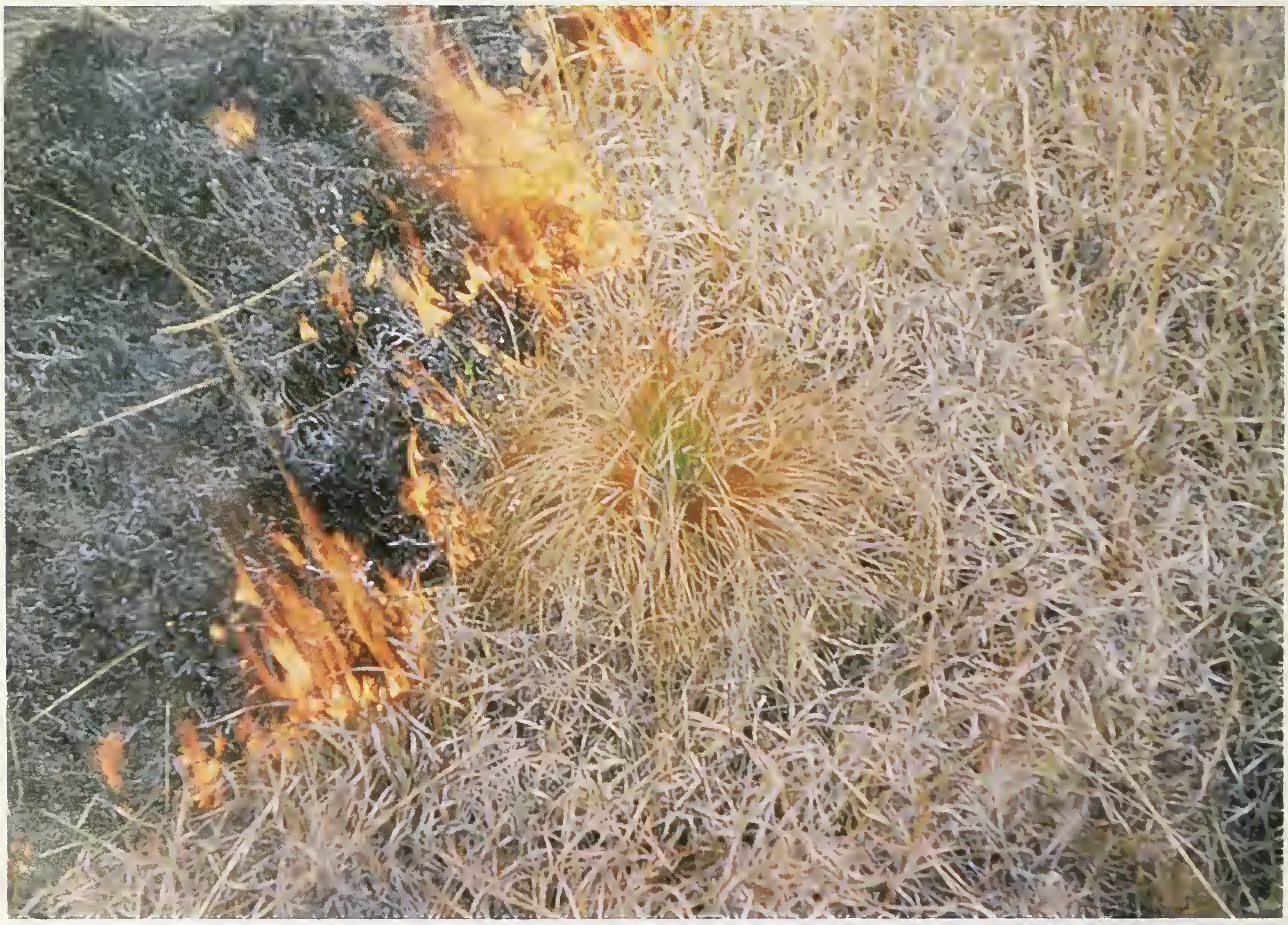

Figure 9.—Prescribed burning kills grass and other plants that compete with longleaf pine seedlings for nutrients, water, and sun. The flames also consume dead, disease-bearing, pine needles.

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